

# Work Plan

## Improving Groundwater Management in the Southern Sierra Fractured Bedrock Aquifer

The work plan for the Local Groundwater Assistance Grant will include the following tasks and deliverables:

Task 1. Assemble and supplement geologic data – A number of geologic maps are available in most areas. Such maps show rock types, geologic contacts, faults, lineaments, fracture trends, and other features. This information is important in terms of preferential groundwater flow paths, favorable well sites, well interference, and groundwater quality. Substantial geologic information is available from the U.S. Geologic Survey, California Division of Mines and Geology, university theses and dissertations, and consultant reports. Mapping for some specific subdivisions is also available.

- Task 1.a. Project manager will work with DWR and assemble maps and data, previous studies and identify data gaps;
- Task 1.b. The hydrogeologist will obtain aerial photos and review to map major lineaments to fill in the gaps in specific areas;
- Task 1.c. The hydrogeologist will determine fracture trends and plot on maps to fill in gaps;
- Task 1.d. The United States Forest Service and the National Park Service hydrologists and other staff will provide an inventory and synthesis of the upper watersheds' data, and to the extent possible, integrate it with downstream information.

These tasks would help accomplish the goals supporting the groundwater portion of the IRWMP, partnering with DWR, integrating data across jurisdictions and gathering data for groundwater management in the southern Sierra.

Deliverable: Technical memo describing geology, watersheds and geomorphology.  
Cost: \$16,620

Task 2. Well yields and pumpage – public wells such as school sites and up to five private wells have already been identified for this study. Well data would only be utilized on a voluntary basis.

- Task 2.a. The hydrogeologist will use completion reports for individual wells to prepare graphs showing well depths and air - test yields in the study area. Hydrogeologist will summarize water system wells, construction data, annual pumpage, and sustainable well yields and estimated total well pumpage for the study area.

This task will help accomplish the goal of gathering data for groundwater management in the southern Sierra.

Deliverable: Summary memos of data gathered and implications.

Cost: \$15,000

Task 3. Water level measurements

- Task 3.a. The hydrogeologist will measure water levels in as many wells as feasible (approximately 15 wells will be measured) during at least two periods: one during the spring and the other during the fall. Wells would be selected on a voluntary basis and for which driller's reports are available. Only wells with appropriate landowner authorization will be sampled. Electric sounders will be used for measuring the water levels. A GPS unit will precisely locate the wells and determine the elevation of the measuring point;
- Task 3.b. The hydrogeologist will determine and plot water level elevations. Water-level elevation contours and direction of groundwater flow maps will then be prepared for the summer and fall. In specific developed areas, where both shallow and deep wells are present, separate maps may be prepared for the shallow and deep groundwater. In addition to these measurements, routine water-level measurements will be made in an estimated 15 wells to determine seasonal water level changes. For these sites, both shallow and deep wells (if available) will be selected for monthly water-level measurements where access is available. These will continue over a period of up to two years;
- Task 3.c. The hydrogeologist will prepare water-level hydrographs for these wells. This will provide some of the best information on the extent and timing of recharge to the shallow and deep groundwater.

These tasks would help accomplish the goal of gathering data for groundwater management in the southern Sierra.

Deliverable: Summary memos of data gathered and implications including water-level hydrographs and well information.

Cost: \$20,000

Task 4. Watershed delineation and watershed budget – Recharge to groundwater in the fractured-rock comes from precipitation. Watersheds can be delineated that are tributary to a well or groups of wells. In order to evaluate recharge, watersheds are mapped based on land surface drainage divides. It is expected that groups of private wells (high density) and locations of water purveyors systems and wells would be highly utilized in delineating tributary watersheds to be evaluated. Long-term isohyetal maps for precipitation are already available.

- Task 4.a. The project manager will work with DWR staff in partnership to assemble information to determine evapotranspiration rates and amounts for the various delineated watersheds based on already developed values for various types of vegetation. These are available primarily from studies of the U.S. Forest Service and the University of California;

- Task 4.b. The project manager will work with DWR staff to evaluate streamflow records to compare precipitation, evapotranspiration, and runoff in the area. In general, groundwater pumpage in the fractured bedrock aquifer is based on pumping water that would have otherwise been used by plants, lost to evaporation, or run off as streamflow. This information will enable development of reasonable values of potential groundwater recharge various watersheds;
- Task 4.c. Potential groundwater recharge would then be determined in developed watersheds, and then compared to the existing pumpage from the hydrogeologist. The potential recharge estimates will be extremely useful in evaluating the carrying capacity of specific parts of the study area.

These tasks would help accomplish the goals of supporting the groundwater portion of the IRWMP, integrating data across jurisdictions and gathering data for groundwater management in the southern Sierra.

Deliverable: Technical memo including evapotranspiration rates, streamflow records, recharge potential.

Cost: \$6,000

#### Task 5. Develop understanding of hydraulic connection between streamflow and groundwater

- Task 5.a. Hydrogeologist will use water-level elevation maps to evaluate the direction of groundwater flow relative to the primary streams;
- Task 5.b. Hydrogeologist will also compare stream channel elevations to groundwater level elevations to evaluate the relationship between streamflow and groundwater. Locations of groundwater recharge from streamflow and groundwater discharge to streams would be determined.

Deliverable: Technical memo including evapotranspiration rates, streamflow records, recharge potential.

Cost: \$8,000

These tasks would help accomplish the goal of gathering data for groundwater management in the southern Sierra.

Task 6. Delineation of water quality problem areas – Several groundwater quality problems have been identified in parts of the Three Rivers. These problems include uranium, nitrates and pathogenic bacteria.

- Task 6.a. First, project manager will summarize and plot available data for water systems and private wells and in partnership with Tulare County Department of Public Health, local districts and DWR;
- Task 6.b. Second, hydrogeologist will develop and carry out a water sampling program for analyses of key constituents to fill in data gaps. Maps would

then be prepared showing approximate problem areas for constituents of concern.

Deliverable: Technical memo including water quality locations and maps.

Cost: \$3,500

These tasks would help accomplish the goal of gathering data for groundwater management in the southern Sierra, assisting identifying water treatment options and needs.

Task 7. Meetings, project management and stakeholder coordination – Data gathered through this study will be summarized and presented to stakeholders in the region at IRWM meetings and Three Rivers residents will be informed of data and progress at Town Hall meetings.

- Task 7.a. Consultants will present during at least two regional water management group meetings, discussing study progress, findings, important data, and draft illustrations, as they become available;
- Task 7.b. Project manager will coordinate with stakeholders, coordinate stakeholder involvement and collaboration, presenting at two town hall or other public meetings. Copies of reports, memos and study results will be made available as handouts;
- Task 7.c. Project manager will coordinate study activities, consultants, reporting and timing.

Deliverable: Stakeholder coordination, presentations at four meetings, handouts and feedback from stakeholders and responses on progress.

Cost: \$18,000

Task 8. Final report – The memos, reports and data will be compiled into a report.

- Task 8.a. The hydrogeologist will prepare a draft technical report, presenting the basic data and interpretation, maps, illustrations, and appendices, as well as recommendations for future studies and monitoring programs. This report will be reviewed by interested parties, the comments addressed, and the final report prepared.

Deliverable: Report with figures.

Cost: \$18,000

#### Task 9. Administrative Tasks

Sierra Resource Conservation District will administer this grant.

- Task 9.a. Quarterly reporting – quarterly reports will be submitted to DWR in a timely fashion;

Task 9.b. Financial administering – time tracking, invoicing and consultant invoice receipt.

Deliverable: Quarterly and final reporting.

Cost: \$2,700